Great Lakes Binational Toxics Strategy

Draft Report for External Review

PCDD (DIOXINS) AND PCDF (FURANS): REDUCTION OPTIONS

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1.0 INTRODUCTION AND REPORT OVERVIEW

Dioxins (polychlorinated dibenzo-para-dioxins, or PCDDs) and furans (polychlorinated dibenzofurans, or PCDFs) are a group of toxic chemical compounds which are inadvertently generated and released into the environment as by-products of various combustion and chemical processes. Due to their toxicity, tendency to bioaccumulate, and persistence in the environment, dioxins and furans have been the subject of ongoing public health and environmental concern. Despite existing controls, they are distributed widely in the environment, sometimes at levels which may pose risk. For example, dioxins/furans have been the cause of numerous fish consumption advisories in the Great Lakes region, and the U.S. Environmental Protection Agency (EPA) has recently estimated that the risks for the general population based on dioxin exposure could be as high as the range of a 1 in 100 to 1 in 1,000 increased chance of experiencing cancer related to dioxin exposure (USEPA, 2000b). In response, various local, state, regional, and national efforts are focusing on achieving further reductions in dioxin contamination. One of these efforts is the Great Lakes Binational Toxics Strategy (Binational Toxics Strategy or GLBTS), which encompasses various activities and strategies being considered under the guidance of a multi-stakeholder GLBTS dioxin/furan workgroup.

On April 7, 1997, Canada and the United States signed the *Great Lakes Binational Toxics Strategy: Canada-United States Strategy for the Virtual Elimination of Persistent Toxic Substances in the Great Lakes*. The Binational Toxics Strategy identified twelve bioaccumulative substances having sufficient toxicity and presence in water, sediments, and/or aquatic biota of the Great Lakes system to warrant concerted action to eliminate their input to the Great Lakes. They are called "Level 1 substances". Dioxins/furans are one of the classes of Level 1 substances, and are the subject of this report, which was prepared in response to the U.S. challenge goal for dioxins and furans written in the GLBTS:

> U.S. Challenge: Seek by 2006, a 75 percent reduction in total releases of dioxins and furans (2,3,7,8-TCDD toxicity equivalents) from sources resulting from human activity. This challenge will apply to the aggregate of releases to the air nationwide and of releases to the water within the Great Lakes Basin, using the September 1994 draft Dioxin Reassessment as an interim baseline. Once U.S. EPA has completed and released its final Dioxin Reassessment, the Reassessment's 1987 emissions inventory will be used as the challenge baseline.

To guide Environment Canada (EC) and the U.S. EPA, along with their partners, as they work toward virtual elimination of the strategy substances, the GLBTS outlined a four-step analytical framework:

1. Gather information
2. Analyze current regulations, initiatives, and programs which manage or control substances
3. Identify cost-effective options to achieve further reductions
4. Implement actions to work toward the goal of virtual elimination

In accordance with Step 3 of the four-step process, this report (the Step 3 report) documents the analysis of available information on dioxin sources and regulations with the goal of identifying the best options for further reductions. Specific goals of this report include the identification of opportunities for new or modified approaches, pollution prevention programs, or other alternative measures, which may accelerate the pace or increase the level of dioxin/furan reduction, while taking into account cost-effectiveness.

First, this report provides a brief overview of dioxins for new readers, including major sources, regulatory control, and non-regulatory programs and incentives. Additional information on dioxin/furan sources and regulations used in this analysis was previously compiled (May 26, 2000) in the GLBTS Step 1 & 2 report for dioxins, *PCDD (Dioxins) and PCDF (Furans): Sources and Regulations (Draft Report)* (USEPA, 2000a). The draft Step 1 & 2 report relied on EPA s 1998 peer reviewed *Draft Inventory of Sources of Dioxin in the United States* (USEPA, 1998). Subsequently, a public release of EPA s updated draft Dioxin Reassessment for external scientific review was provided on EPA s website in June, 2000 (USEPA, 2000b). In addition, at the time of this report preparation, EPA was in the process of implementing further revisions to the updated draft Dioxin Reassessment for submission to EPA s Science Advisory Board (SAB) (USEPA, 2000c). Where applicable, information from these updated draft Dioxin Reassessment documents, which includes revised inventory estimates and information related to estimates of dioxins and furans releases that is not included in, or is different from, that presented in the GLBTS Dioxin Step 1 & 2 report, is also reflected in this Step 3 report.

The remainder of this report discusses potential reduction opportunities for dioxins and furans, with a primary focus on presenting the findings of the multi-stakeholder GLBTS dioxins/furans workgroup. In 1999-2000, this workgroup, which included representatives from states, industry, and environmental and other non-governmental organizations, evaluated the major sources of dioxin to determine which pose the best opportunities for further reductions in the Great Lakes basin. As an options paper, this document only explores potential ways to achieve additional dioxin/furan reductions, with a primary focus on the Great Lakes region. It does not recommend a specific path of action for EPA or EC on a national basis, or imply a commitment on the part of EPA or EC. In addition, GLBTS goals do not address exposure issues. To address exposure issues, as well as dioxin emissions, on a national basis, the Agency is in the process of developing the EPA Cross-Media Dioxin Strategy. The national Dioxin Strategy will integrate EPA's diverse set of dioxin activities into a comprehensive national program that is consistent with and responsive to the findings of the final Dioxin Reassessment, once it is completed. This Step 3 report serves to identify options for achieving further reductions in dioxin releases, with a primary focus on the Great Lakes region.

2.0 BACKGROUND INFORMATION ON DIOXINS/FURANS

2.1 CHEMICAL DESCRIPTION AND HEALTH EFFECTS OF DIOXINS/FURANS

Dioxins and furans are halogenated aromatic hydrocarbons which can have from one to eight chlorine substituents. There are 75 individual chlorinated dioxins and 135 individual chlorinated furans. Each individual dioxin and furan is referred to as a congener. Both the number of chlorine atoms and their positions determine the physical and chemical properties, and therefore, the fate and toxicity of a given congener. In addition to dioxin and furan congeners, coplanar polychlorinated biphenyls (PCBs), a subset of PCBs, also exhibit dioxin-like toxicity due to their structural and conformational similarities to dioxin compounds. Dioxins, furans, and dioxin-like PCBs are commonly found as complex mixtures when detected in environmental media, biological tissues, or as releases from specific sources. Generally, dioxins and related compounds are colorless crystals or solids that have a low water solubility, high fat solubility (i.e., are lipophilic), and low volatility. They bind strongly to soils and sediments and are extremely stable under most environmental conditions, making them persistent once released in the environment. Because they are lipophilic, they also tend to bioaccumulate.

Only dioxin/furan congeners with chlorines attached at a minimum in the 2,3,7, and 8 positions, as those shown in Figure 2-1, exhibit the high toxicity associated with dioxin. One compound, 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), is the best studied of this class of compounds and serves as the reference compound for assigning toxicity equivalence factors for related congeners. For risk assessment purposes, estimates of the toxicity of sources which contain a mixture of PCDD and PCDF congeners are often expressed as toxicity equivalents (TEQ). TEQ is calculated by multiplying concentrations of each dioxin and furan congener present in a source with a toxicity equivalency factor (TEF). The TEF is an estimate of each congener s toxicity relative to the toxicity of 2,3,7,8-TCDD. The TEQ values for each congener are added together for the total TEQ concentration. Thus, concentrations of dioxins and furans represented as a TEQ concentration provide a quantitative estimate of toxicity as if all congeners present in the mixture are a toxic equivalent mass of 2,3,7,8-TCDD. Thirteen of the total 209 PCB congeners are also thought to have dioxin-like toxicity, and are often included in the calculation of dioxin/furan TEQs in toxicity assessments. Historically, various TEF schemes have been defined and used to present results. The different TEF schemes, and a new uniform TEQ nomenclature that clearly distinguishes between the different TEF schemes, are discussed in detail in the updated draft Dioxin Reassessment (see USEPA, 2000b: Section 1.2 of the Integrated Summary, or Part II of Chapter 9 Toxicity Equivalence Factors (TEF) for Dioxin and Related Compounds). In the updated draft Dioxin Reassessment, the nomenclature I-TEQ_{DF} is used to denote the International TEF scheme adopted by EPA in 1989, and TEQ_{DF}-WHO_{98} is used to refer to the 1998 WHO update to the TEFs previously established by WHO for dioxins, furans, and dioxin-like PCBs (USEPA, 2000b). The I-TEQ_{DF} abbreviation is equivalent to the TEQs reported in the 1998 Draft Dioxin Inventory (USEPA, 1998). For this reason in this Step 3 report, the calculations of the percent contribution of a given source to the total inventory were performed based on I-TEQ_{DF}.

Figure 1. Chemical structure of 2,3,7,8-TCDD and 2,3,7,8-TCDF.

The latest data on exposure and health effects for dioxins and related compounds are provided in detail in the multi-volume draft Health Assessment document included in the updated draft Dioxin Reassessment (USEPA, 2000b). Current data (e.g., human and animal studies, mode of action research) support a causal relationship between 2,3,7,8-TCDD exposure and cancer hazard in humans (USEPA, 2000b). Other dioxin-like compounds (congeners) and mixtures are characterized by EPA only as likely human carcinogens, primarily due to a lack of epidemiological evidence and congener-specific toxicity data.

2.2 DIOXINS/FURANS SOURCES AND RELEASES OVERVIEW

Major sources and releases of dioxins, furans, and dioxin-like PCBs in the U.S. Great Lakes basin have been discussed previously in the GLBTS Step 1 & 2 report for dioxin (USEPA, 2000a), which relied on EPA s 1998 peer reviewed *Draft Inventory of Sources of Dioxin in the United States* (USEPA, 1998). The subsequent release of the updated draft Dioxin Reassessment includes updated release estimates for certain sectors, although these estimates are also still considered draft. These revisions, however, do not qualitatively or otherwise significantly affect the Step 1 & 2 report or the past year s sector analysis by the GLBTS dioxin/furan workgroup because the source estimates maintain the same relative ranking as the 1998 draft estimates. In addition, the updated draft Reassessment does not affect the utility of the GLBTS workgroup's discussions or conclusions regarding sources and reduction opportunities in the Great Lakes area, as these were developed in tandem with EPA headquarters dioxin experts, and took into account the latest inventory information.

In addition to including revised emissions estimates, the updated draft Dioxin Reassessment presents a revised qualitative confidence rating scheme. This scheme replaces the one used in the 1998 Draft Inventory which provided a numeric range of emissions to characterize uncertainty in the emission estimates for the quantifiable sources and an order of magnitude estimate for the less well-characterized sources. The new confidence rating scheme, presented in Table 1, uses qualitative criteria to assign a high, medium, or low confidence rating to the emission factor and activity level for those source categories for which emission estimates can reliably be quantified. The overall confidence rating assigned to a quantified emission estimate was determined by the confidence ratings assigned to the corresponding activity level and emissions factor.

Table 1. Revised Qualitative Confidence Rating Scheme Used in the Updated Draft U.S. Dioxin Reassessment (USEPA, 2000b)

Confidence category	Confidence rating	Activity level estimate	Emission factor estimate
Categories/media for which emissions can reasonably be quantified			
A	High	Derived from a comprehensive survey	Derived from a comprehensive survey
B	Medium	Based on estimates of average plant activity level and number of plants or limited survey	Derived from testing at a limited but reasonable number of facilities believed to bey representative of source category
C	Low	Based on data judged possibly nonrepresentative	Derived from testing at only a few, possibly nonrepresentative facilities or from similar source categories
Categories/media for which emissions cannot be reasonably quantified			
D	Preliminary estimate	Based on extremely limited data, judged to be clearly nonrepresentative	Based on extremely limited data, judged to be clearly nonrepresentative
E	Not Quantified	No data	1) Argument based on theory but no data 2) Data indicating dioxin formation, but not in form that allows developing an emission factor

If the lowest rating assigned to either the activity level or emission factor terms is high, then the category rating assigned to the emission estimate is high (also referred to as A). If the lowest rating assigned to either the activity level or emission factor terms is medium, then the category rating assigned to the emission estimate is medium (also referred to as B). If the lowest rating assigned to either the activity level or emission factor terms is low, then the category rating assigned to the emission estimate is low (also referred to as C). For many source categories, either the emission factor information or activity level information were inadequate to support development of reliable quantitative release estimates for one or more media. For some of these source categories, sufficient information was available to make preliminary estimates of emissions of dioxins/furans or dioxin-like PCBs; however, the confidence in the activity level estimates or emission factor estimates was so low that the estimates were not included in the sum of quantified emissions from sources with confidence ratings of A, B, or C. These estimates were given an overall confidence class rating of D. For

other sources, some information exists suggesting that they may release dioxin-like compounds; however, the available data were judged to be insufficient for developing any quantitative emission estimate. These estimates were given an overall confidence class rating of E.

In the updated draft Dioxin Reassessment, EPA s revised best estimates of total national dioxin and furan releases to all environmental media (products are not included) from reliably quantifiable sources (i.e., those with confidence rating of A, B, or C as defined above) were approximately 12,400g I-TEQ_{DF} (13,500 g TEQ_{DF}-WHO_{98}) in 1987 and 2,600 g I-TEQ_{DF} (2,800 g TEQ_{DF}-WHO_{98}) in 1995. In revisions made for the SAB submission (USEPA, 2000c), emissions from open burning were upgraded to a confidence rating of C and therefore added to the quantifiable sources, while emissions from forest, brush and straw fires were downgraded to a confidence rating of D and removed from the quantifiable sources, as discussed in Section 3.2 below. Therefore, in the SAB submission, total national releases from quantifiable sources are estimated as 12,800 g I-TEQ_{DF} (14,000 g TEQ_{DF} -WHO_{98}) in 1987 and 3,000 g I-TEQ_{DF} (3,300 g TEQ_{DF} -WHO_{98}) in 1995.

EPA concluded in the updated Reassessment that quantifiable environmental releases of dioxins/furans in the U.S. are dominated by releases to air from combustion sources, and are estimated to be an order of magnitude greater than all other categories combined. Once finalized, the Reassessment s 1987 emissions inventory will be used as the baseline for the GLBTS challenge goal of a 75 percent reduction by 2006 in total releases of dioxins and furans from sources resulting from human activity. Some of the larger sources of quantifiable dioxin/furan release included in the updated inventory emissions estimates, as well as sources with preliminary estimates and suspected sources, are listed in Table 2 below.

Of particular note in the updated draft Reassessment, new preliminary estimates of reservoir source releases to water from urban runoff and rural soil erosion (190 and 2,700 g I-TEQ_{DF} in 1995, respectively) suggest that, on a nationwide basis, total nonpoint/reservoir releases of dioxin-like compounds to waterways (i.e., potentially leading to human exposure via consumption of contaminated fish) are significantly larger than point source dioxin releases. The updated draft Reassessment also supports the finding that the contribution of reservoir sources to human exposure may be significant.

Table 2. Major Sources[1] of Dioxins/Furans in the Updated Draft U.S. Dioxin Reassessment (USEPA, 2000b)

Source Category	Quantifiable Sources	Sources with Preliminary Estimates	Unquantified / Suspected Sources
Combustion (releases to air)	municipal waste combustion, medical waste incineration, hazardous waste incineration, crematoria, sewage sludge incineration, vehicle fuel combustion, residential and industrial wood combustion, industrial/utility oil combustion, utility coal combustion, cement kilns, and forest, brush and straw fires[2]	biogas and landfill gas combustion, residential oil combustion, industrial and residential coal combustion, asphalt mixing, landfill fires, accidental fires, backyard barrel burning[3]	uncontrolled combustion of PCBs, agricultural burning
Metals smelting and refining (releases to air)	iron sintering, and secondary aluminum and copper smelting/refining	coke production, electric arc ferrous furnaces, ferrous foundries	primary aluminum, primary nickel, primary magnesium[4]
Chemical manufacturing and processing (releases to water and land)	bleached chemical wood pulp and paper mills (water), municipal wastewater treatment sludge (land), 2,4- Dichlorophenoxy acetic acid (land)	municipal wastewater (water)	mono- to tetrachlorophenols, pentachlorophenols, chlorobenzenes, chlorobiphenyls (leaks/spills), dioxazine, tall oil-based liquid soaps
Reservoir Sources		urban runoff and rural soil erosion (water)	air, sediments, water, biota, PCP-treated wood

[1] For this table, sources listed under the quantifiable and preliminary estimates columns are limited to those that were estimated individually to release greater than 5 g I-TEQ_{DF} / yr in 1995.
[2] Dioxin emissions from forest, brush and straw fires are expected to receive a lowered confidence rating of D in the revised Dioxin Reassessment for SAB review (i.e., they will be considered preliminary estimates and will not be included in the total quantifiable inventory).
[3] Backyard barrel burning is expected to receive a quantitative estimate with a confidence rating of C in the revised Dioxin Reassessment for SAB review.

[4] Primary magnesium is expected to receive a preliminary estimate in the revised Dioxin Reassessment for SAB review

2.3 SUMMARY OF EFFORTS TO CONTROL DIOXIN/FURAN RELEASES

Regulatory Efforts

EPA has pursued the control and management of dioxin through each of its major program areas; collectively, these actions place regulatory controls on all of the major well-defined industrial sources of dioxin. Dioxin releases to air are controlled under regulations promulgated by EPA under authority of the Clean Air Act (CAA) and its amendments, which require emissions limits for dioxins and other hazardous air pollutants based on maximum achievable control technology (MACT). With full implementation of the MACT rules, the major categories of commercial and municipal waste combustion are under direct regulation for their dioxin emissions. Dioxin releases to water are managed through a combination of risk-based and technology-based tools established under the Clean Water Act (CWA). Clean up of dioxin-contaminated lands is an important part of the EPA Superfund and RCRA Corrective Action programs. Table 3 provides an overview of current federal regulation relevant to control of dioxin and related compounds in the Great Lakes basin. The regulatory programs listed are described in further detail in the GLBTS Step 1 & 2 report for dioxin (USEPA, 2000a).

Table 3. Regulatory Overview of Dioxins and Furans in the U.S.

CAA	CWA	SDWA	RCRA	SARA / EPCRA and CERCLA	FIFRA and TSCA

§112(c)(6): Major source categories identified; MACT standards promulgated for MWC (40CFR 60), MWI (62 FR 48347), and HWC (64FR 52827)	CWA Priority: Listed priority pollutants (40CFR 423); subject to NPDES effluent limitations under §304(b) (40CFR 122) and general pretreatment (40CFR 403) CWA Biosolids Rule: proposed standard of 300 parts per trillion toxic equivalents for dioxins in biosolids (64 FR 72045)	NPDWR / MCL: 30 pg/L (enforceable) MCL goal for 2,3,7,8-TCDD is zero	RCRA: Several dioxin-bearing wastes are F-listed hazardous wastes, and as such are subject to land disposal restrictions (40CFR 261.31-32) Land disposal restrictions for certain dioxin-containing and wood-preserving wastes (40CFR 268.30-31 Subpart C) Universal treatment standards for dioxin levels in waste (40CFR 268.48)	CERCLA §103: Spills of 2,3,7,8-TCDD >1 lb. must be reported to the National Response Center SARA §313: October 29,1999 Amendment adds dioxins and dioxin-like compounds to those chemicals subject to TRI reporting requirements, with a threshold reporting quantity of 0.1 gram/year (64FR 58666)	FIFRA: Sale of Silvex and 2,4,5-T canceled for all uses (USEPA 1998); PCP use allowed only for wood on restricted basis (52FR 2282-2293) TSCA §4: Dioxin / Furan Test Rule for certain commercial organic chemicals (52FR 21412-21452)
Pulp and Paper Cluster Rule (63FR 18504): Sets new NESHAPS/MACT air standards specifically for the pulp and paper source category (under CAA 112(b)) and water effluent limitations and pretreatment standards for certain facility subcategories (under CWA 304(b), 307)					

CAA: Clean Air Act

CERCLA: Comprehensive Environmental Response,

Compensation, and Liability Act (Superfund)
CWA: Clean Water Act
FIFRA: Federal Insecticide, Fungicide, Rodenticide Act
HMIWI: Hospital/Medical/Infectious Waste Incinerators
HWC: Hazardous Waste Combustors
MACT: Maximum Achievable Control Technology
MCL: Maximum Contaminant Level (Drinking water standard)
MWC: Municipal Waste Combustors
NESHAPS: National Emissions Standards for Hazardous Air Pollutants (HAPs)
NPDES: National Pollutant Discharge Elimination System
NPDWR: National Primary Drinking Water Regulations
PCP: Pentachlorophenol
RCRA: Resource Conservation and Recovery Act
SARA/EPCRA: Superfund Amendment Reauthorization Act / Emergency Planning and Community Right-to-know Act
SDWA: Safe Drinking Water Act
TRI: Toxic Release Inventory
TSCA: Toxic Substances Control Act

Non-Regulatory Efforts

Table 4 presents an overview of some of the major non-regulatory programs, activities, and efforts that may directly or indirectly address issues related to dioxins and furans in the Great Lakes. The programs listed are described in further detail in the GLBTS Step 1 & 2 report for dioxin (USEPA, 2000a).

Table 4. Overview of Major Non-Regulatory Programs Concerned With Dioxin Releases

International Programs	Great Lakes Binational Toxics Strategy; International Joint Commission Critical Pollutant; Great Lakes Lakewide Management Plans; Remedial Action Plans (RAPs) for Great Lakes Areas of Concern (AOCs); United Nations Environment Program (UNEP) Persistent Organic Pollutants (POPs) Initiative; United Nations Economic Commission for Europe (UNECE) Long-Range Transboundary Air Pollution (LRTAP) Initiative; NAFTA; Commission for Environmental Cooperation Tri-lateral North American Regional Action Plan.
Domestic Programs	USEPA Persistent, Bioaccumulative, and Toxics (PBT) Initiative; Voluntary Advanced Technology Incentives Program for pulp and paper mills, CAA 112(k) Urban Area Source Program - Integrated Urban Air Toxics Strategy; Waste Minimization National Plan; Contaminated Sediment Management Strategy; Wildland Fire Prevention/Education; Western Lake Superior Sanitary District (WLSSD) Pollution Prevention Efforts and Zero Discharge Pilot Project (ZDP).

Industry Activities	Health Care Without Harm and other health care industry initiatives; wood-stove changeout programs and workshops; voluntary paper industry program to limit dioxin concentrations in land- applied pulp and paper sludge (during interim time before full implementation of the pulp and paper effluent guidelines); voluntary industry agreements to restrict the levels of dioxin found in chloranil (used in the manufacture of certain pigments and tires) and chlorinal-tire manufacturer agreement to import only low dioxin chlorinal.
Programs Focusing on Dioxin Exposure Reduction	National Fish and Wildlife Contamination Program and Fish Consumption Advisories; Environmental Justice and Children s Health Initiatives; FDA Actions.
Information Gathering and Monitoring Efforts	Dioxin Exposure Initiative (DEI) Efforts; other sources and emissions research, exposure and effects research, and routine monitoring efforts

3.0 IDENTIFYING DIOXIN/FURAN REDUCTION OPPORTUNITIES

3.1 DESCRIPTION OF THE GLBTS WORKGROUP S SECTOR ANALYSIS PROCESS FOR IDENTIFYING OPTIONS

In July 1999, the GLBTS dioxin/furan workgroup began the development of a process to systematically evaluate the major sectors contributing to dioxin/furan releases in the Great Lakes basin, with the intent of helping workgroup participants identify the top priorities for work group focus. This eventually led to the adoption of a decision tree process, which allowed the workgroup to assign a GLBTS priority level to each sector amongst the major targeted sectors. Priority level designation was based on consideration of available source and release information, and regulatory and programmatic frameworks. Primary goals of this ranking process were to define priority areas for initial workgroup focus, and to determine if the GLBTS workgroup could potentially provide any added value (i.e., by designating a sector as high priority) to reduction processes already in place for a given sector. The dioxin decision tree chart used by the workgroup in this process is attached below.

Figure 2. Draft Dioxin Decision Tree

In the decision tree process, which the workgroup began to implement in November 1999, a source category was defined as any source or sector identified in the EPA or EC dioxin inventories for which emission estimates exist. A source category could also include other sources not included in the inventories, but which were of concern to the work group participants. For example, although there have been significant reductions in dioxin emissions from the quantifiable industrial sources, preliminary order of magnitude estimates at the time of workgroup discussion suggested that some uncontrolled combustion sources (e.g., landfill fires at 1,000 g I-TEQ_{DF} and backyard trash burning at I-TEQ_{DF} in the 1998 Draft Inventory) may still be of significant concern (USEPA, 1998). For the initial ranking process, a candidate significant source category to be subjected to the decision analysis was defined as a source or sector whose dioxin emission estimates were equal to or exceeded 2% of the total 1998 Draft U.S. Inventory or the 1999 Ontario emission inventory, or a source or sector whose dioxin emissions might otherwise be considered significant to the Great Lakes basin. If a source or sector had only order of magnitude emission estimates from the 1998 Draft U.S. Inventory, then the order of magnitude estimate was considered in determining the significance of the source category. The rationale for picking 2% was the fact that in the inventories, the 2% cutoff appeared to separate major sources accounting for the majority of emissions from a large number of minor sources responsible for only a very small percentage of the total emissions. The final list of candidate

sources that were subjected to the decision tree analyses by the workgroup are listed in Table 5 below.

Table 5. Sources Subjected to the GLBTS Dioxin Workgroup Decision Tree Analysis

Combustion sources		
* municipal waste combustion	* landfill fires	* diesel fuel combustion
* medical waste incineration	* forest fires	
* open burning	* wood waste combustion	
* residential wood combustion		
* hazardous waste burning cement kilns/hazardous waste incinerators	* utility coal combustion	
Metals smelting and refining		
* iron sintering	* steel manufacturing electric arc furnaces (EAF)	* secondary copper smelting
Reservoir sources (anthropogenic structures)		
* pentachlorophenol treated wood		

The decision tree analysis was used by the workgroup both to assign a priority ranking of high, medium, or low to each candidate sector, as well as to identify significant information gaps that needed to be filled before a final ranking could be assigned. This GLBTS priority ranking was meant to convey the workgroup opinion about the significance of the reductions possible, taking into account the ease with which the reductions could be obtained. Two important points about the process deserve mention. First, the process was not intended to provide a numerical ordering of sources by priority, nor to capture fine distinctions in priority status between sources. Rather, the process was intended to identify a few obvious sources or sectors where there were opportunities for additional dioxin reduction efforts. Second, the GLBTS analysis was focused on dioxin reduction opportunities that went beyond programs or efforts that were already in place and expected to continue. For example, a source coming under new MACT regulations may have significant reduction opportunities, but may have limited opportunities for significant reductions over and beyond those expected from the established MACT regulatory program. Therefore, in the GLBTS process, a sector could be designated as low GLBTS priority on the basis of either a) minimal emissions or b) minimal reduction options for the GLBTS.

The GLBTS decision tree analysis process and the prioritization of sources and sectors, was conducted as an open process in which any interested stakeholder was given the opportunity to participate. The workgroup had the input and participation of a wide variety of stakeholders, including states, industry, and environmental and other non-governmental organizations.

3.2 FINDINGS OF THE SECTOR ANALYSIS

Table 6 provides an overview of the findings of the sector analyses conducted by the GLBTS dioxin/furan workgroup using the decision tree process described above. The priority level assignments refer only to a sector s ranking relative to opportunities for the GLBTS dioxin/furan workgroup. For the workgroup, the ranking did not preclude the pursuance of a project for any sector, nor was it intended to define closure for the workgroup or indicate a national priority level for a given sector. Candidate sectors will be periodically revisited by the workgroup participants as priority activities are completed.

Table 6. Overview of Results of the Decision Tree Analysis Process and GLBTS Priority Assignments for Significant Dioxin/Furan Sources in the Great Lakes Basin.

Source / Sector [1]	GLBTS Priority Designation
Municipal waste combustion (MWC)	Low priority
Medical waste incineration (MWI)[2]	Low (US) / medium (Canada) priority
Backyard trash / open burning	High priority
Residential wood combustion	High priority
Pentachlorophenols (treated wood)	Medium (US) / low (Canada) priority
Cement kilns (hazardous waste burning)	Low priority
Iron sintering	Low priority
Steel manufacturing (EAF)	No priority designation (US) due to lack of data / low priority (Canada)
Secondary copper smelting	Low priority (US) / no priority designation (Canada) due to lack of data
Hazardous waste incinerators	Low priority
Wood waste combustion	Low priority
Utility coal combustion	Low priority
Diesel fuel combustion	Low priority
Landfill fires	No priority designation due to lack of data
Forest fires	Low priority

[1] Sources included in this initial sector analyses by the workgroup were limited to those that are greater than 2% of either the 1998 Draft U.S. or 1999 Ontario emissions inventories. These inventories represented the best information available at the time of workgroup discussions; values presented in these inventories are currently under review and will potentially change in the final versions.
[2] Shaded rows indicate candidate sectors for further GLBTS workgroup actions.

Following is documentation of the workgroup discussions and information sharing that led to the priority designation for each sector.

3.2.1 Municipal Waste Combustion (MWC) and Medical Waste Incineration (MWI)

Emissions Estimates and Significance. In the U.S., MWC and MWI have historically been the two largest industrial categories of dioxin releases to the environment, and quantifiable dioxin/furan emissions estimates for MWC and MWI have been made. In the updated draft Dioxin Reassessment (USEPA, 2000b), MWC has been given a confidence rating of B , which indicates that the characterization of MWC was judged to be adequate for quantitative estimation with medium confidence in the emission factor and at least medium confidence in the activity level. MWI was given a confidence rating of C , which indicates that the characterization of MWI was judged to be adequate for quantitative estimation, although with low confidence in either the emission factor and/or the activity level. In Ontario, Canada, the reliability of MWC emissions is high (the largest emitter is tested annually), with approximately 95% of the Ontario total originating from the Hamilton-Wentworth Solid Waste Reduction Unit (SWARU) facility in Hamilton, Ontario. The Ontario MWI emissions estimates are currently being revised, and are expected to increase significantly in an updated Canadian dioxin/furan inventory due to be released soon. MWC and MWI comprised approximately 44 and 18 percent, respectively, of the total quantified releases to air in the U.S. in 1995 (USEPA, 2000b), and 19 and 3 percent, respectively, of the 1999 Canadian Ontario Inventory.

Regulations and Programs. There is relatively extensive regulatory control of air emissions from MWC and MWI either in place or in development. U.S. EPA promulgated Maximum Achievable Control Technology (MACT) standards in 1995 for municipal waste combustors, with a 1997 amendment calling for the exemption of small MWC units from coverage under the 1995 regulations. Although MWC facilities with capacities less than 35 tons/day are not currently subject to regulation, the 1998 U.S. Inventory estimated that the larger MWCs were the source of the great majority of emissions, with the 14 largest facilities estimated to account for 80% of all emissions. For the large MWC facilities (>250 ton/day), a Federal Implementation Plan has been finalized, with a compliance deadline of December, 2000. MACT rules specifically for small MWC facilities (35-250 ton/day) were proposed in 1999 and are planned to be finalized by 2001. For MWI, EPA finalized MACT rules in 1997, with a compliance deadline of September, 2002. Some smaller combustion facilities may also be covered by the emissions rules for Boilers and Industrial Furnaces (BIFs), which should cover other types of facilities burning municipal waste not covered by MWC and MWI rules. Details on the implementation and compliance status for the various facility categories and in the various Great Lakes states are provided in the GLBTS Step 1 & 2 report for dioxin (USEPA, 2000a).

In Ontario, the development of Canada Wide Standards (CWS) is expected to reduce MWC and MWI air emissions, with draft standards currently proposed and planned to be achieved by 2006 for existing facilities. Once CWS are finalized, provinces have the burden of implementation. Until then, regulatory agencies can only encourage voluntary efforts (e.g.,

upgrading to carbon injection systems) to reduce emissions. However, voluntary upgrades of control devices are predicted to be unlikely to occur before 2005 because there are no incentives now in place. In addition, because the municipality in which the SWARU facility is located is currently reviewing its waste management plan and may be shifting away from incineration, the municipality is hesitant to invest in upgrades.

Expected/Predicted Reductions. Overall, the decrease in estimated total releases of dioxins/furans in the U.S. between 1987 and 1995 (approximately 80%) is primarily attributed to reductions in air emissions from municipal and medical waste incinerators (USEPA, 2000b). This decrease is thought to be the result of improved combustion and emission controls, as well as from the closing of a number of facilities. Estimated decreases of MWC and MWI emissions across the inventory s two reporting years (1987 and 1995) are considered fairly reliable estimates due to several factors, including: a) half of the MWI emissions reductions are due to closing of facilities, and b) for MWC, most of the reductions took place in the 14 facilities that accounted for about 80% of the emissions from that source category. Because implementation and compliance regarding MACT rules are an still underway, further emissions reductions are anticipated for both categories. EPA estimates that when full compliance with the MACT rules for MWC (as applied to all new and existing waste-to-energy plants and incinerators with the capacity to burn more than 35 tons of garbage per day) is reached that the annual emissions resulting from municipal solid waste incinerators will decline significantly to about 24 g TEQ/year (USEPA, 1998). EPA expects full compliance with MACT rules for MWI to result in a decline of nationwide emissions from this source to about 6-7 g TEQ/year (Winters, personal communication, 2000). As facilities demonstrate compliance with MACT standards through stack testing, the reliability of emission estimates will also increase.

Given the existence of established regulatory controls and processes in the U.S. and Canada, the key question for the dioxin/furan workgroup regarding MWC and MWI was whether further reduction opportunities might exist after regulations. To comprehensively evaluate and determine a final priority status for MWC and MWI, the workgroup also considered the potential for additional dioxin reductions to be achieved through voluntary pollution prevention (P2) and waste management projects (e.g., front-end separation and waste minimization), and discussed MWC/MWI ash disposal as an aspect of these incineration sectors that may warrant future workgroup attention.

Issues and Potential Opportunities: Waste Management. In order to assess the potential for dioxin reduction through changes to waste management practices at municipal and medical waste combustion facilities, the workgroup discussed available information on the relationship between chlorine content of the feedstock and the effectiveness of waste separation efforts on reducing dioxin/furan emissions. This information included EPA research and a waste incineration study conducted in the Western Lake Superior Sanitary District (WLSSD). Overall, workgroup assessment indicated that the chlorine-dioxin relationship is not simple, with differences existing depending on whether the combustion is poorly or well controlled. The discussion identified three ways in which dioxin is released as a result of the combustion process: 1) dioxin is in the fuel to start with and is released during the combustion process, 2)

dioxin is generated as a result of incomplete combustion, or 3) although combustion is complete, dioxin is formed in the post-combustion environment via de novo synthesis. If the temperature is above or below a certain range (i.e., 400 to 750 °F), dioxin formation will not occur (USEPA, 1999). In general, there are three requirements for the formation of dioxin during complete combustion: 1) appropriate temperatures for formation, 2) sufficient retention time, and 3) the presence of catalytic surfaces. At facilities with well controlled combustion and good pollution controls, these three factors result in low levels of dioxin formation and release. When facilities are operated according to the MACT standards, background concentrations of chlorine are adequate to support the levels of dioxin formation occurring, and additional sources of chlorine (e.g., polyvinyl chlorides) will generally not result in additional dioxin formation. Therefore, in well-controlled combustion, the chlorine content of the feedstock is typically not a controlling factor in the magnitude of dioxin formation. However, this may not be the case in instances where combustion is less well controlled, and in some cases, chlorine in the feedstock may play a significant role in controlling dioxin formation. The latest findings in the updated draft U.S. Dioxin Reassessment also support the conclusion that, although chlorine is an essential component for the formation of dioxins/furans in combustion systems, chlorine levels in feed are not the dominant controlling factor for rates of dioxin/furan stack emissions. For any individual commercial-scale combustor, however, circumstances may exist in which changes in chlorine content of feed could affect dioxin emissions (USEPA, 2000b).

The GLBTS dioxin workgroup also considered the waste-management-oriented efforts of Health Care Without Harm (HCWH), which is a collaborative campaign for environmentally responsible health care, including the reduction of dioxin (and mercury) emissions from medical waste incineration. Historically, hospitals have disposed of all waste, whether medical or non-medical, via MWI because this method was considered cheaper than separating it. HCWH discourages unnecessary incineration of hospital waste materials, especially recyclable materials, with a focus on eliminating the need to burn wastes. In addition, HCWH is also specifically concerned with products made with polyvinyl chloride (PVC) plastic, due to the potential for PVC to release dioxin during its manufacture and incineration. Activities HCWH has conducted include: meeting with hospitals to encourage and discuss means for waste reduction (e.g., materials separation), encouraging the use of non-PVC alternatives in hospitals (e.g., polyethylene IV bags), and encouraging non-incineration alternatives to waste disposal. Significant reductions in MWI emissions were observed by HCWH when hospitals began separating medical waste from municipal waste. These reductions were attributed in part to reductions in the total volume of waste burned at MWI, which historically had fewer combustion controls than MWC. Information gaps may still exist regarding the quantities of non-medical/non-infectious waste being included in the MWI waste stream, and regarding the quantities of waste being disposed of by incineration as compared to alternative methods. Additional information is needed regarding the fate of waste diverted from closed facilities, particularly MWIs, in the Great Lakes basin. U.S. state contacts revealed some transfer of medical waste to MWC or pyrolysis facilities.

Issues and Potential Opportunities: Ash. MWC and MWI ash disposal issues were also assessed by the GLBTS dioxin workgroup in an effort to prioritize these sectors. In the

U.S., combustion ash is regulated as hazardous under RCRA only if it exhibits toxicity characteristics; however, there are no toxicity characteristic thresholds for dioxin specifically. In addition, municipal solid waste (and MSW ash) is specifically excluded from being a listed hazardous waste and may be disposed of in a municipal landfill. Details on U.S. regulation pertaining to ash disposal are provided in the GLBTS Step 1 & 2 report for dioxin (USEPA, 2000a). Nationally, ash from waste combustion facilities is thought to be typically disposed of in a monofill where the ash is isolated from other substances that might encourage the leaching of dioxin. Because dioxins and furans are extremely hydrophobic chemicals, the absence of other carriers (an oil, for example) would greatly reduce the leaching of dioxins from these landfills. Each state also usually has its own medical waste program, including MWI ash disposal regulations. A better characterization of the specific land disposal practices for MWC and MWI ash actually occurring within the U.S. Great Lakes watershed was identified by the dioxin/furan workgroup as an information need.

In Canada, available information did not indicate that Canada had a monofill requirement for MWC or MWI ash. Bottom ash is usually not considered toxic, and may be disposed of in a sanitary landfill. Fly ash is considered toxic, although it may be combined with bottom ash prior to disposal, which may affect disposal requirements. Some research is currently being conducted in Canada on alternative technologies for destruction/reduction of dioxins and furans in ash. This research, however, is primarily being driven by the expense of landfill disposal in Canada, rather than by exposure concerns.

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing available information regarding the various aspects of MWC and MWI in the U.S. and Canadian Great Lakes basin, the GLBTS dioxin/furan workgroup concluded that, for air emissions, there was currently substantial regulatory control of MWC and MWI in place or being developed in both the U.S. and Canada, and that at this time, further reduction opportunities were generally limited. The group also concluded that more information was needed on the management and disposal of fly and bottom ash from waste incineration to determine significance regarding dioxin/furan releases. Acknowledging this, the workgroup designated final priority levels for MWC and MWI based on air emissions only. For MWC, a low priority assignment was made on the basis of significant reduction efforts for air emissions already in place in both the U.S. (MACT standard implementation) and Ontario (Canada Wide Standard development), with the caveat that progress in compliance would be assessed by the workgroup periodically in both countries. For MWI, the low priority assignment in the U.S. was also made on the basis of significant reduction efforts already underway with MACT standard implementation, again with the condition that compliance would be monitored. In Ontario, although the Canada Wide Standard development would also potentially reduce MWI air emissions, a medium GLBTS priority level was assigned due to new data suggesting that stack emissions from MWI in Ontario may be much greater than estimated in previous inventories.

3.2.2 Backyard Trash / Open Burning

Emissions Estimates and Significance. In the 1998 Draft Inventory (USEPA, 1998) dioxin/furan releases from backyard trash burning were given an order of magnitude estimate of 1,000 g I-TEQ_{DF} / yr. In the updated Dioxin Reassessment (USEPA, 2000b), they were assigned a preliminary estimate of 1,125 g I-TEQ_{DF} released to air in 1995 with a confidence rating of D, which indicates that sufficient information was not available to include the estimate in the sum of quantified emissions. However, these preliminary emissions estimates indicated to the workgroup that uncontrolled trash burning has the potential to be a very significant source of dioxins (USEPA, 1998; USEPA, 2000b). In revisions to the updated draft Dioxin Reassessment for SAB review, the confidence rating for backyard burning will be upgraded to C, and a quantitative emission estimate of 628 g TEQ_{DF}-WHO_{98} in 1995 will be included in the total inventory for dioxin/furan releases (USEPA, 2000c). Estimates of dioxin/furan emissions from open burning in Ontario are not included in the 1999 Ontario Inventory.

Other potential sources of concern within the open burning category include teepee burning in Canada, which is characterized by low-tech, municipal-scale, uncontrolled burning of waste in areas without landfill capability (e.g., Newfoundland), the combustion of garbage in residential fireplaces (e.g., cited as an occurrence in Minnesota), and agricultural burning. EPA s dioxin program intends to expand its research on agricultural burning to include better characterization of stubble-field, grassland, and silvicultural burns. Agricultural burning, however, differs in many way from open burning of trash in that the burn cycle is often an integral part of certain ecosystems, such as grasslands and Douglas-fir forests.

Regulations and Programs. Currently in the U.S., there is no uniform standard of regulatory control of air emissions from open burning. Open burning is not federally regulated by the CAA. Individual state, county, tribal, and local governments have various regulations that address open burning. However, one of the problems related to open burning identified by the GLBTS dioxin/furan workgroup is that the local regulations that are in place are not stringently enforced. Details on some local regulation in the various Great Lakes states are provided in the GLBTS Step 1 & 2 report for dioxin (USEPA, 2000a).

Issues and Potential Opportunities. To assess opportunities related to dioxin reductions from open burning sources, the GLBTS dioxin/furan workgroup considered: a) recent EPA research on factors influencing dioxin emission from open burning, b) a recent study conducted by the Western Lake Superior Sanitary District (WLSSD) on the prevalence and public perceptions of open burning, and c) the potential for voluntary actions such as outreach and educational campaigns.

EPA research has indicated that there are generally two main questions or unknowns in determining dioxin emissions from open barrel trash burning, including: 1) the prevalence and distribution of the practice, and 2) the emission factors and variables that affect dioxin emission levels (e.g., burning practice, type of trash). Although the presence of chlorinated materials in waste is not the most important factor in dioxin formation for many commercial-scale facilities, chlorine content of waste may play a more significant role in the level of dioxin emissions for uncontrolled combustion, such as the open burning of household waste (USEPA, 2000b). A

better characterization of the prevalence and distribution of open burning, in the Great Lakes basin specifically, was identified by the dioxin/furan workgroup as an important information need.

A recent study conducted in Minnesota and Wisconsin to gain information on open burning practices and perceptions, and in order to better target future outreach and education on reduction options, was evaluated by the dioxin/furan workgroup (WLSSD, 2000). The study consisted of phone surveys of 780 area residents, 380 each in Minnesota and Wisconsin. Questions asked focused on public opnion regarding open burning, such as type and quantity of garbage burned, frequency of garbage burning, reasons for burning, and other demographic information. Key findings of the study showed that the most common reasons for burning garbage were convenience and to avoid the high cost of garbage service in many areas. When asked about environmental and health concerns associated with open burning, perceptions were that it was an important, but only moderate danger. Fire danger was ranked in the survey as the number one concern associated with open burning of garbage, and when asked about possible incentives for stopping open burning, many respondents said it was likely that there was nothing that would convince them to cease the practice. In the WLSSD, information collected in the study was planned to be used in putting together an educational campaign.

The dioxin workgroup considered voluntary efforts applicable to achieving reductions in dioxin emission from open burning. Public education and outreach and the development of infrastructures to provide alternatives to open burning were all identified as significant aspects of open burning that needed attention to effect reductions. Local fire departments were mentioned as a resource that may have potential for conducting successful communication efforts geared at encouraging the public to reduce open burning, or to modify open burning practices to release less dioxins.

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing available information regarding the various aspects of open burning in the U.S. and Canadian Great Lakes Basin, the GLBTS dioxin/furan workgroup concluded that open burning should be designated as high priority for workgroup actions. This decision was based on high (although uncertain) emissions estimates in the U.S., and the presence of substantial opportunities to promote reductions (i.e., due to the lack of regulatory control).

3.2.3 Residential Wood Combustion

Emissions Estimates and Significance. Quantitative emissions estimates for dioxin/furan releases from residential wood combustion (RWC) have been made in the U.S. and Canada. In the updated draft Dioxin Reassessment (USEPA, 2000b), residential wood combustion has been given a confidence rating of C , which indicates that the characterization of this source was judged to be adequate for quantitative estimation, although with low confidence in either the emission factor and/or the activity level. In Ontario, although the confidence in emissions estimates for residential wood combustion is low (based on the EPA emission factor only), preliminary estimates indicate this source may be a very important source of dioxin emissions in Ontario. This source comprised about 2.5% percent of the total quantified

releases to air in the U.S. in 1995 (USEPA, 2000b), and 26.3% of the total 1999 Ontario Emissions Inventory.

Additional data on the nature of dioxin/furan releases from wood stoves is currently being gathered in a Canadian wood stove testing program underway to assess the dioxin reduction potential of EPA-certified stoves. The study will compare emissions from old conventional and new certified wood stoves; in addition, it is hoped that the results of the study will help to determine if there is a correlation between particulate matter (PM) and dioxins/furans in wood stoves. EPA-approved stove technology has been shown to reduce particulate matter emissions by up to 90%; therefore, determining the relationship between PM and dioxins would allow inferences on dioxin reductions. Preliminary results from the Canadian tests of certified stoves showed that dioxin and furan emissions from wood stoves were predominantly in the gaseous phase. Final test results on the certified stoves are currently being analyzed. There is no information yet on dioxin releases for conventional stoves, although testing is underway.

Regulations and Programs. In the U.S., there is relatively little regulatory control of air emissions from residential wood combustion. Although, under a 1988 New Source Performance Standard (NSPS) ruling, EPA requires certification to control particulate matter for residential wood-fired heaters manufactured after 1990, the phase-out of older wood-fired heaters that do not meet EPA s PM limit is slow to take effect. In addition, because the exact nature of the association between dioxins/furans and PM is unknown, the effects, if any, of PM control technology on dioxin/furan emissions is also unknown. In the U.S., wood stove changeover pilot programs were conducted in Traverse City, MI, and Green Bay, WI in February, 2000. The goal of these pilot projects was to gauge the regional response and potential impacts of a wood stove changeover. Those turning in old conventional wood stoves received a 15% rebate on the purchase of a new stove (as based on an agreement between manufacturers and dealerships). Approximately one-third of switch-overs are to gas units or liquid propane fuel. Other aspects of the project include: potential partnering with steel industry groups to pick up the old stoves for use as scrap steel, and a certification of destruction requirement from the scrap yard to verify that the old stoves are not being put back into service. Result of the pilots to date showed that gas utilities, insurance companies, and fire departments may be valuable partners in these changeover efforts in the future. Sponsors, including the Hearth Products Association, are contemplating expanding the project, pending an assessment of the success in the two pilots.

In Canada, wood stoves are a high priority sector, with previous and/or ongoing activities including workshops, educational campaigns, a pilot changeout program in eastern Ontario in early 1999, and a National point-of-purchase campaign. In addition, the Final Canada-wide Standards (CWS) for wood stoves are scheduled for 2001. Initial commitments under the CWS include: updating the Canadian Standards Association standards for new wood-burning appliances; developing a national regulation for new, clean-burning residential wood-burning appliances; conducting national public education campaigns; and assessing the option to undertake a national woodstove upgrade or change-out program.

Because RWC also accounts for a large proportion of the national benzo(a)pyrene (B(a)P) emissions, the GLBTS B(a)P workgroup has been highly involved in the planning of future wood stove changeover and other outreach campaigns.

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing available information regarding the various aspects of residential wood combustion in the U.S. and Canadian Great Lakes basin, the GLBTS dioxin/furan workgroup concluded that residential wood combustion should be designated as high GLBTS priority for dioxin/furan workgroup actions. This decision was based on high emissions estimates and the presence of opportunities to promote reductions. Better information on the effectiveness of PM controls on dioxin/furan emissions from wood stoves was also identified as a need. However, although the workgroup has a high interest in residential wood combustion and wood stove reductions, after discussing the current activities, the workgroup decided that at the present time (i.e., pilot project stage) leadership of the GLBTS actions directed at RWC should remain with the B(a)P workgroup. The reason for this includes both the fact that the B(a)P workgroup has coordinated GLBTS wood stove change-out support to date, as well as the fact that the reductions in B(a)P emissions from wood stoves are better characterized for B(a)P at this point than for dioxin. The workgroup agreed to revisit the wood stove issue after the results of the Canadian emissions studies and other pilot projects are available, at which time they may be better able to reassess potential coordination activities and appropriate reductions actions related to wood stoves.

3.2.4 Pentachlorophenol Treated Wood

Emissions Estimates and Significance. Evidence suggests that significant amounts of dioxin compounds are produced annually as a contaminant of pentachlorophenol (PCP), a wood preservative, and are tied up in PCP-treated products (USEPA, 2000b). The only currently permitted use of PCP in the U.S. is as a wood preservative in utility poles and crossarms. In addition, EPA s current assessment of PCP indicates that the most significant mass of PCP is present in utility poles. EPA s inventory estimates of the quantities of dioxins existing as a contaminant in manufactured pentachlorophenol (8,400 g I-TEQ_{DF} / yr in 1995 [USEPA, 2000b]) are high (at more than three times the total inventory of estimated releases to air). However, reliable emission estimates for dioxin/furan releases to the environment from PCP-treated wood have not been made, and therefore, releases from PCP-treated products are not included in the U.S. national dioxin inventory. EPA research suggests that a minimal amount of dioxin is released from PCP manufacturing facilities and in-use utility poles. In both the U.S. and Canada, uncertainty exists on whether the PCP (and dioxin contamination) present in in-use utility poles actually poses an environmental risk, especially with respect to ultimate disposal. Due to the limited information available at the time of decision tree analysis discussions, particularly regarding pole disposal, the dioxin workgroup was unable to conclude that PCP-treated utility poles were not a significant source in the Great Lakes basin. Therefore, because of the magnitude of the mass of dioxins involved and the potential for this sector to be a source, PCP-treated utility poles remained a medium GLBTS priority in the U.S. with a current focus on information gathering. In the 1999 Ontario Emissions Inventory, estimated releases of

dioxins/furans to all media from PCP-treated utility poles total about 1.7% of the entire inventory.

At the time of workgroup assessment of this sector, industry contacts reported that currently, only 5% of the PCP used in Canada over the past 5 years has been used in Ontario, and that the primary utility in Ontario (Ontario Hydro) uses copper chromium arsenate to preserve its utility poles. In addition, wood preserving facilities which currently use PCP are reported to be very limited on the U.S. side of the Great Lakes basin. On the other hand, a treated utility pole can be expected to last for approximately 30 years. It is estimated that there are in excess of 120 million treated-wood utility poles in place in the United States. Since PCP has been the dominant preservative used for the treatment of utility poles in the last 25 years, many of these poles are treated with PCP. Assuming that 3% of the existing poles are replaced every year, pole removals potentially constitute a significant volume of material that must be either disposed of or recycled (AWPI, Penta Council).

Regulations and Programs. Details on regulations pertaining to PCP and PCP-treated wood are provided in the GLBTS Step 1 & 2 report (USEPA, 2000a). Currently in the U.S., PCP is regulated under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA). Based on a 1987 Settlement Agreement with PCP manufacturers, uses of PCP and its salts were limited to wood uses only, and tolerance levels were set for amounts of certain dioxin contaminants in the material. EPA is currently evaluating PCP for re-registration, which could impact the feasibility of various pollution prevention and emission reduction options. Utility poles taken out of service are not necessarily considered a waste and can be reused consistent with their intended end use. Although PCP is not a RCRA-listed hazardous waste, PCP is on EPA s list of constituents that could cause a waste to be classified as a hazardous waste through its Toxicity Characteristic Leaching Procedure. To evaluate this possibility, the Electric Power Research Institute conducted testing of PCP-treated poles and crossarms. In these tests, the average PCP level in the extracts was 1.92 ppm, well below EPA's 100 ppm threshold. The results of this testing confirm that PCP-treated wood is generally not a hazardous waste under RCRA, and it may generally be disposed of as ordinary solid waste. Although PCP treated wood is not a RCRA regulated waste, it may be a CERCLA liability if stockpiled or disposed of improperly. Thus, industry indicated that potential liability associated with improper management encourages proper management and disposal or re-use in the United States.

The Canadian Environmental Protection Agency (CEPA) has recently released a Strategic Option Process (SOP) for the management of CEPA-toxic substances. Because PCP contains dioxins, furans, and hexachlorobenzene, which are all CEPA-toxic substances, PCP treatment of wood falls under this initiative. Implementation of this program has been planned through June 2006. The program covers recommendations for reducing exposure to toxic substances during manufacture of the preservative, application of the preservative, use of treated wood products, management of used treated wood, transportation of both preservative chemicals and the treated products, and contamination of sites. During dioxin workgroup discussion of the Canadian Wood Preservers SOP, it was reported that the SOP on treated wood has greatly reduced the use and re-use of PCP treated poles, largely due to increased awareness of potential liability. The

SOP is also helping greatly with gathering documentation on current management practices. The SOP is primarily voluntary. However, if the voluntary approach of the SOP is not deemed successful, Environment Canada and Health Canada will consider a regulatory approach.

Issues and Potential Opportunities: Life-cycle Management. For the utilities, there is a viable market for re-use of utility poles taken out of service. Poles sold for re-use in the U.S. are accompanied by a Materials Safety Data Sheet (MSDS) explaining the use restrictions. Industry indicated that the MSDS consumer safety sheets which are distributed with reused poles identify appropriate and inappropriate uses (e.g., PCP treated poles may not be used for residential burning). In addition, after the secondary user is done with the poles, they become industrial solid waste which is subject to disposal requirements in some cases. Poles that are no longer acceptable for carrying power lines are often used for fence posts, landscape materials, or supports for vehicle shelters. If PCP-treated poles must be disposed of, rather than reused or recycled, EPA recommends disposal in municipal or industrial waste landfills properly permitted for the management of non-hazardous wastes (AWPI, Penta Council). The utility that generates used PCP-treated utility poles is responsible for determining the regulatory status of the used poles and ensuring that management and disposal are in compliance with local, state, and federal regulations.

Another alternative for recycling is the use of PCP-treated wood for fuel in industrial or commercial boilers or furnaces with capacities in excess of 20 million Btu/hr. There are a number of facilities in the U.S. and Canada that have been permitted to combust PCP-treated wood (AWPI, Penta Council). It was noted in workgroup discussions that the American Wood Preservers Institute (AWPI) is working to get more penta-treated poles to be used as fuel. Regarding dioxin/furan emission associated with incineration disposal (e.g., cement kiln fuel), EPA reported that cement kilns using PCP treated wood as fuel generally do not have an impaired ability to meet MACT standards (i.e., as long as quench technology is present). However, it was noted by the workgroup that local sensitivities associated with burning certain types of fuel were also important.

The best available information at the time of workgroup discussions on the ultimate disposal fate of utility poles taken out of service was taken from an unpublished report discussed at a February 1999 conference on utility poles in Florida. This information, which was based on a limited survey of predominantly large utility companies in the southeastern United States, suggested that only about 50% of utility poles currently have a controlled or known disposal fate. About 23% of the poles went into landfills, about 14% were disposed of in incinerators, 31% were given away, and 18% were sold. Although the survey covered all utility poles, not just PCP-treated poles, the survey can be considered representative of PCP-treated utility pole fate. However, because smaller utilities, rural utilities, or utilities in the western states were not included in the survey, national scale management of used utility poles largely remains unknown.

Although the largest mass of known PCP is thought to be in treated utility poles, the workgroup also considered the significance of other PCP sources, including those outside the basin. For example, there are some geographically limited problems at manufacturing / wood preserving sites that will require remediation. Acknowledging this, the dioxin workgroup

identified the primary concern associated with PCP in the Great Lakes basin as the fate / life-cycle management of the remaining poles. In particular, the workgroup cited information on how many are being actively managed to the end of their lives (e.g., via landfill disposal, as cement kiln/co-generation fuel) as a key information need.

In response to this information need, the Utility Solid Waste Activities Group (USWAG) is planning to conduct a broad (nationwide) information gathering survey among its member companies on the actual disposal and fate of utility poles that have been taken out of service. This effort is being planned on an accelerated schedule, as possible. In addition, the Canadian Wood Preservers SOP is promoting research on tracking the disposal fate of utility poles taken out of service in Canada under several task management groups, including the guidance groups conducting life-cycle assessment / impact studies, a waste management group working on an approved hierarchy of methods, and an outreach group. Ontario Hydro is also currently conducting an assessment of remaining poles in service.

Workgroup Conclusions and GLBTS Priority Ranking. Overall, the dioxin workgroup concluded that Canada has less uncertainties than the U.S. with regards to PCP treated wood life-cycle management because of the SOP. In the U.S., more information is needed on the fate of PCP treated poles and on the regulatory drivers that may affect pole disposal. In addition, the question of whether there is an infrastructure in place in the U.S. to trace these recycled/reused poles, and to assure that they find an ultimate proper disposal was identified by the workgroup as a key information need. Regarding the assignment of a GLBTS priority level to this sector, after assessing available information regarding the various aspects of PCP manufacture and use in the U.S. and Canadian Great Lakes basin, the GLBTS dioxin/furan workgroup concluded that PCP treated poles in the U.S. would be designated as a medium GLBTS priority due to a lack of information on ultimate disposal fate of PCP-treated utility poles. This priority designation will be revisited by the workgroup, dependent on more information becoming available regarding de facto disposal. In Canada, PCP treated wood was designated as a low GLBTS priority due to the controls and life-cycle analysis of PCP treated wood that are underway through the Canadian Wood Preservers SOP.

3.2.5 Hazardous Waste Burning Cement Kilns

Emissions Estimates and Significance. Quantitative emissions estimates for dioxin/furan releases from hazardous waste combusting (HWC) cement kilns have been made in the U.S. and Canada. In the updated draft U.S. Dioxin Reassessment (USEPA, 2000b), HWC cement kilns have been given a confidence rating of C , which indicates that characterization of this source was judged to be adequate for quantitative estimation, although with low confidence in either the emission factor and/or the activity level. In the U.S., dioxin/furan emissions from cement kilns comprised about 5.8% percent of the total quantified releases to air in 1995 (USEPA, 2000b). In Ontario, cement kilns account for approximately 2.2% of the total inventory of emissions; these emissions estimates were based on actual testing of 50% of Ontario kilns in 1997. There are a significant number of cement kilns burning hazardous waste in the Great

Lakes basin, including 26 on the U.S. side (none in WI or MN), and 10 on the Canadian side (hazardous and non-hazardous waste burning facilities included).

Regulations and Programs. In the U.S., there is relatively extensive regulatory control of air emissions from HWC cement kilns either in place or in development. Under the combined authorities of the CAA (MACT standards) and the Resource Conservation and Recovery Act (RCRA), U.S. EPA regulates dioxin emissions from facilities that burn hazardous waste. U.S. EPA finalized MACT standards for new and existing Hazardous Waste Incinerators (including hazardous waste-burning cement kilns) in 1999 with a compliance deadline of September, 2002. Details on the implementation and compliance status for the various facility categories and in the various Great Lakes states are provided in the GLBTS Step 1 & 2 report for dioxin (USEPA, 2000a). Hazardous waste combustion ash carries the RCRA-listing of the hazardous waste burned and must be disposed of accordingly under RCRA Subtitle C Land Disposal Restrictions, and Universal treatment standards for dioxin-containing wastes. In 1999, EPA also proposed regulations limiting the dioxin content of cement kiln dust from cement plants when these by-product materials are used as soil additives. Pollution control technology is in place in Canadian cement kilns (e.g., electrostatic precipitators, baghouses), although with the primary intention of controlling other pollutants (e.g., particulate matter), not dioxins and furans.

Expected/Predicted Reductions. To comprehensively evaluate and determine a final priority status for HWC cement kilns, the dioxin workgroup considered the accuracy of predicted emission reductions from cement kilns. EPA reports that current emissions from HWC cement kilns are probably much lower than the 1995 estimates, due to significant technology upgrades (i.e., quench) that have occurred since the time of the 1995 estimate. Therefore, because the 1995 emissions estimates are likely not reflective of the technology in place today, emission levels after full MACT compliance may also be lower than expected. In addition, in the process of reaching compliance with the RCRA rules and in the MACT development process, a significant database of emissions data has been complied by the cement kiln industry. Because there is now actual testing data, there will no longer be a need to extrapolate emissions from emission factors; EPA is working on making new estimates. Currently, EPA s Office of Solid Waste (OSW) has the most current, accurate data on cement kiln emissions in the U.S. (obtained as a result of RCRA certification requirements), which represent real-time data on all facility types.

Information gathered as a part of the MACT development process on current cement kiln emissions and dioxin formation chemistry generally indicate that significant progress had already been made in reducing cement kiln dioxin emissions. Between 1990 and 1997, EPA recognizes that cement kilns have had about a 97% voluntary reduction in dioxin/furan emissions (e.g., by using quench technology, inlet temperature controls, etc.). EPA research also supports the importance of temperature control devices which cool combustion gases quickly through the temperature range of about 400 to 750°F in limiting dioxin/furan formation at cement kilns (USEPA, 1999; USEPA, 2000b).

Issues and Potential Opportunities. In the priority assignment process, the dioxin workgroup considered the influence of waste input and existing control technology, as well as cement kiln dust disposal, as issues that may warrant future workgroup attention.

EPA reports that although studies show some inconsistencies, results tend to indicate that cement kiln dioxin emissions are more a result of the combustion process rather than the type of waste inputs, and that the burning of hazardous waste in cement kilns generally does not have an impact on dioxin/furan emissions. For example, this has been observed in the case of the Fast Track Rule, in which waste control measures (such as waste minimization or separation) did not have the same effect after technology upgrades occurred. Therefore, in regards to dioxin emissions, efforts geared towards control of the waste fuel were probably more effective as pre-regulation interim control. It was noted that the primary motivation for burning hazardous waste at a cement kiln facility is to drive down auxiliary fuel costs; the disposal of hazardous waste may provide extra revenue.

Regarding ash from HWC cement kilns (i.e., cement kiln dust), industry reported that because facilities are controlling dioxin stack emissions by preventing formation in the first place, this type of strategy also prevents the accumulation of dioxins/furans in the ash. Cement kiln dust is generally considered a useful product, and may be put back into the cement product, or is sometimes used as a soil amendment similar to lime. In proposed land application restrictions, EPA reported that dioxin/furan limits are set low enough so that the resulting soil concentrations will not be altered significantly. In the U.S., cement kiln dust is also sometimes put into landfills.

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing best available information regarding the various aspects of hazardous waste burning cement kilns in the Great Lakes basin, the GLBTS dioxin/furan workgroup concluded that there was currently strong regulatory control of this source in place in the U.S., low emissions in Ontario, and that at this time, further reductions opportunities existing after regulations were generally limited. Acknowledging this, the workgroup reached agreement that cement kilns should be assigned a low GLBTS priority status, based on progress already made in emission reductions, voluntary activities by the industry, and adequate management that will be in place regarding cement kiln dust.

3.2.6 Iron Sintering

Emissions Estimates and Significance. In the updated draft U.S. Dioxin Reassessment (USEPA, 2000b), emissions estimates for dioxin/furan releases from iron sintering facilities have been made, as based on new quantitative testing data from two facility types. These emissions estimates have been given a confidence rating of B , which indicates that characterization of this source was judged to be adequate for quantitative estimation with medium confidence in the emission factor and at least medium confidence in the activity level. The previous inventories only had order of magnitude estimates due to a lack of test data available for iron sintering. EPA indicated that although it would be ideal to have even more testing data (i.e., a broader range of

facilities), the database now was much better than several years ago and additional testing would probably not fall into a high priority designation. In Ontario, there were two iron sintering plants: one plant (Algoma) shut down, and the remaining plant (Stelco) is the single largest point source remaining in Ontario. In 1998, Stelco re-conducted emissions testing and results showed dioxin emissions of 5.7 to 6 g TEQ / yr. Therefore, although iron sintering emissions have been estimated to be relatively low in the U.S. (i.e., about 1% of the total quantified releases to air in 1995 [USEPA, 2000b]), this sector did meet the GLBTS criteria for a candidate significant source category in Canada, comprising about 16.3% of the total 1999 Ontario Emissions Inventory.

Regulations and Programs. Currently in the U.S., there is relatively little regulatory control of air emissions from the iron sintering sector. The Iron and Steel Foundry category MACT standard is scheduled to be issued by the year 2000, although the effects of this ruling on dioxin emissions are unclear. In contrast, efforts to reduce emissions from the iron sintering sector are relatively extensive in Ontario. The Iron and Steel SOP and Canada Wide Standards (CWS) pollution prevention programs are in place or are being developed. New testing data have been presented in the CWS process, and technology options are currently being researched under the SOP. Industry representatives reported that the Stelco facility has been working on the development of reduction options, with a goal of a 50% reduction in dioxin/furan emissions by 2005. They are also currently designing new equipment (e.g., considering using a pretreatment nozzle system before the scrubber).

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing available information regarding iron sintering in the U.S. and Canadian Great Lakes Basin, the GLBTS dioxin/furan workgroup concluded that opportunities for further reductions from this sector were generally limited at this time; therefore, the iron sintering sector was given a low GLBTS priority level assignment, dependent on the success of the Canadian reduction mechanisms. From the U.S. perspective, the low GLBTS priority designation was a result of consideration of new data which indicate that iron sintering emissions are low (relative to the total U.S. inventory). From the Canadian perspective, the designation was due to the fact that there was probably limited value to be added by the GLBTS to the Iron and Steel SOP and the CWS process for iron sintering already underway in Canada. The workgroup emphasized that the low priority designation, in the future, would be dependent on the success of the Canadian reduction mechanisms (CWS) already underway.

3.2.7 Steel Manufacturing Electric Arc Furnaces (EAFs)

Emissions Estimates and Significance. The U.S. does not currently have sufficient emissions data available on steel manufacturing (EAF) to include a quantitative estimate in the dioxin emissions inventory. In the updated draft Dioxin Reassessment (USEPA, 2000b), steel manufacturing (EAF) was given preliminary release estimates to air with a confidence rating of D, which indicates that sufficient information was available to make preliminary estimates; however, the confidence in the activity level estimates or emission factor estimates was so low that the estimates cannot be included in the sum of quantified emission from sources with

confidence ratings of A, B, and C. One of EPA s concerns with the available test data is that the measurements may not reflect start-up conditions, particularly in light of concerns that higher emissions may occur during start up. Based on preliminary estimates, this source would likely not meet the GLBTS criteria of a significant source category, at an estimated 44.3 g I-TEQ$_{DF}$ /yr released to the air in the U.S. in 1995 (USEPA, 2000b). Although steel manufacturing emissions have been estimated to be relatively low in the U.S., this sector does meet the GLBTS criteria of a significant source category in Canada, comprising about 12.1% (~4.25 g TEQ / yr) of the total 1999 Ontario Emissions Inventory. There are five steel EAF facilities in Ontario. Information on the number of steel EAF facilities in the U.S. Great Lakes basin was unavailable at the time of this report preparation.

Regulations and Programs. Currently in the U.S., there is relatively little regulatory control of air emissions from the steel manufacturing sector. The Iron and Steel Foundry category MACT standard is scheduled to be issued by the year 2000, although the effects of this ruling on dioxins emissions are unclear. In Canada, the Iron and Steel SOP and CWS pollution prevention programs are being developed (see iron sintering discussion) and will apply to steel EAF.

Issues and Potential Opportunities: Data Quality and Additional Testing. At the time of workgroup assessment of this sector, the key discussion point regarding steel EAF, as well as the limiting factor in reaching closure on a GLBTS priority level assignment, was the accuracy and availability of emissions data. Both the U.S. and Canada have used a European emission factor to develop current emissions estimates, although new testing data in Canada has indicated that the Canadian facility s emission factor is significantly lower than the European factor. Possible reasons for differences in the North American and European emissions estimates were considered by the workgroup, including infrastructure differences, differences in scrap quality, and age of facility. For example, in some cases Europe does not have the infrastructure in place to dispose of wastes such as chlorinated solvents, and as a result, these materials may be incorporated into the scrap pits. Furthermore, North American facilities may use cleaner scrap, which comes from in-house recycled sources as well as purchased scrap (mostly from automobiles). However, the workgroup also acknowledged that some European studies had shown that the quality of the scrap does not affect dioxin emissions as long as the fuel system is properly operating and has proper cool-down (i.e., quench) technology in place to prevent dioxin formation.

Regarding additional data gathering efforts in Canada, the Dofasco EAF facility has recently conducted testing, and remaining Canadian data gaps will be addressed with additional testing that is being pursued at other facilities, including stack testing planned at Courtice and Gerdau Steel. The Council for Great Lakes Industries (CGLI) is coordinating with EC in the development of a voluntary stack testing guidance document.

Recent testing conducted at the Canadian Dofasco facility, which indicated that the European emission factor (previously used in generating emissions estimates) was significantly higher than the Dofasco emission factor, was discussed by the workgroup. Testing of the

Dofasco EAF was representative of a full operation cycle, including all cycle process (i.e., charging, initializing batch, refining, etc.). Although Dofasco is a very new facility, and it may not be representative of the entire sector, industry representatives explained that it is the design of the fuel system, not the age of the facility, that determines level of emissions. This discussion led the workgroup to conclude that additional information gathering was especially important in light of the fact that there is such variety in steel EAF fuel systems. Generally, representatives from the Canadian steel industry and EC agreed that significant new testing data was forthcoming for EAF, and that it would be sufficient to assess whether this sector should be a high, medium, or low priority for the GLBTS in Canada.

Regarding U.S. activities to gather more information on steel EAF dioxin emissions, no additional testing is currently planned. EPA is in the initial stages of defining its highest priority testing needs, although no schedule for testing is yet in place. The workgroup examined the issue of whether this sector met the criteria (i.e., likely to be a significant source in the basin) to warrant additional information gathering efforts. Industry representatives thought that the preliminary data available indicated that steel EAF facilities were not likely to be a significant source in the basin and did not merit putting a high priority on further testing. However, others in the workgroup cited the high variability in EAF emissions and the need for additional test data from a wide variety of facilities to accurately estimate steel EAF emissions and provide conclusive data on which to base a final conclusion.

Industry representatives cited the high expense of testing and lack of incentives as barriers to voluntary industry efforts towards obtaining additional data. In addition, EPA does not have a framework or guidance available for industries developing testing programs. The workgroup assessed available information on the expense associated with industrial emissions testing. It was estimated that at the time of this report the cost for a single test run would be approximately $30,000 to $35,000. This cost would include sampling and dioxin/furan analysis; however, this price would not include any additional expenses such as setting up sampling platforms and probe stations. An EAF industry representative noted that many facilities do not have actual stacks, but rather roof vents, as part of their design; therefore, modifying sampling procedures to account for this may also result in additional expense.

Although workgroup participants agreed that there is little data on steel EAF in the U.S., steel industry representatives expressed doubt that U.S. EAF facilities would volunteer to conduct testing in the absence of EPA funding because many facilities had no current budget for testing. Furthermore, due to economic burdens, mandated testing for dioxins might possibly have the result of dampening industry willingness to participate in other voluntary activities, such as the voluntary mercury reduction and PCB phase out activities underway at Indiana steel mills. One possible solution suggested was for EPA to provide financial assistance for facilities that are voluntarily conducting testing, similar to the assistance EC provides industries for voluntary testing programs. It was unknown whether EPA is in a position to assist steel mills in financing dioxin testing, although it was suggested that the steel EAF sector is a good candidate for combining GLBTS information gathering efforts, i.e., testing for other GLBTS substances such as mercury. This discussion emphasized the importance of using a sector-based approach and

fully understanding the potential ramifications of activities being considered on other reductions/monitoring efforts.

The workgroup also discussed the potential for the U.S. to use new Canadian emissions factor data to revise emissions estimates for U.S. steel EAF facilities. Discussion included consideration of the likelihood that U.S. data would be similar to Canadian data. In general, the raw materials and processes used in U.S. and Canadian facilities were reported to be similar. For example, while some European facilities accept municipal solid waste, most U.S. and Canadian facilities use only pure scrap. However, although EAF facilities are all similar process-wise, they often are quite unique with regards to the system configuration (e.g., fuel delivery, gas cooling systems).

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing available information regarding steel manufacturing in the U.S. and Canadian Great Lakes Basin, the GLBTS dioxin/furan workgroup concluded that, in the absence of any identified testing currently being conducted or planned in the U.S., efforts to promote additional testing were needed. This information need applies to U.S. steel EAF facilities only, because current information gathering efforts in Ontario are sufficient with regards to steel EAF. In addition, new testing data forthcoming for steel EAF in Canada will be sufficient to assess whether this sector should be designated as a high, medium, or low priority for the GLBTS in Ontario. In the U.S., the workgroup did not assign a GLBTS priority level to steel manufacturing EAF due to the lack of test data, and acknowledging this, suggested that ideas for encouraging additional testing should be developed.

3.2.8 Secondary Copper Smelting

Emissions Estimates and Significance. Quantitative emissions estimates for dioxin/furan releases from secondary copper smelting in the U.S. have been made. In the updated draft U.S. Dioxin Reassessment (USEPA, 2000b), estimates from secondary copper smelting have been given a confidence rating of C , which indicates that characterization of this sector was judged to be adequate for quantitative estimation, although with low confidence in either the emission factor and/or the activity level. Secondary copper smelting was not included in the 1999 Ontario Emissions inventory, but assessment of this sector is currently underway in Canada. While Canadian emissions are unknown, this source comprised about 10.6% of the total quantified releases to air in the U.S. in 1995 (USEPA, 2000b). However, more current EPA data indicates that all of the high emission facilities in the U.S. have closed and that there are only two secondary copper smelters remaining. EPA reported that the dioxin/furan emissions from these two remaining facilities were estimated to be about 10 to 20 g I-TEQ/yr maximum, and possibly as low as 5g I-TEQ/yr (Winters, personal communication, 2000).

In general, the previously high estimates of dioxin/furan releases were largely a result of emissions from the old Franklin secondary copper smelters, in which copper wire encased in insulation material was processed to liberate the copper. Indications are that this industry has

undergone significant consolidation in recent years, i.e., all of the high emission facilities have closed down, and that the feed scrap is now cleaner.

Regulations and Programs. Currently there is relatively little regulatory or other control of air emissions from secondary copper smelting. In the U.S., although there are currently no regulations under the CAA controlling dioxin air emissions from the secondary copper smelting industry, this sector is on the list of additional source categories EPA intends to include under CAA 112(k). Comment is still under request for this source category (63FR 49249).

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing available information regarding secondary copper smelting in the U.S. and Canadian Great Lakes basin, the GLBTS dioxin/furan workgroup concluded that few opportunities exist for this sector at this time. In the U.S., secondary copper smelting was designated a low GLBTS priority, due to new data indicating very low emissions from remaining facilities, and dependent on the high emission facilities remaining closed. Secondary copper smelting in Canada, however, received no priority designation due to a lack of information.

3.2.9 Landfill Fires

Emissions Estimates and Significance. The U.S. does not currently have sufficient emissions data available on landfill fires to include a quantitative estimate in the inventory. In the updated draft Dioxin Reassessment (USEPA, 2000b), preliminary release estimates to air indicate that landfill fires have the potential to be a very large source category. To date, emissions estimates have been made with a confidence rating of D, which indicates that sufficient information was available to make preliminary estimates; however, the confidence in the activity level estimates or emission factor estimates was so low that the estimates cannot be included in the sum of quantified emission from sources with confidence ratings of A, B, and C. Based on the magnitude of the preliminary U.S. emission estimate, 1,050 g I-TEQ_{DF} /yr released to the air in the U.S. in 1995 (USEPA, 2000b), this source was considered a candidate significant source category. The U.S. inventory used a Swedish emission factor in deriving the U.S. inventory estimate for landfill fires, of which there are two types: accidental and underground methane fires. Estimates of dioxin/furan emissions from landfill fires in Ontario are not included in the 1999 Ontario Inventory.

Regulations and Programs. At the time of workgroup assessment, no verifiable information was available on regulatory or other control of air emissions from landfill fires. Current regulations regarding landfills were of interest to the workgroup (e.g., permits, reporting requirements, management plans), but details were unknown. The workgroup noted that older landfills not under RCRA may be important, and that in past years (pre-regulation), landfill fires were often set intentionally.

Workgroup Conclusions and GLBTS Priority Ranking. In summary, after assessing available information regarding landfill fires in the U.S. and Canadian Great Lakes basin, the GLBTS dioxin/furan workgroup concluded that information is needed on both emission factors

and on the frequency of landfill fires in both the U.S. and Canada. Higher priority was placed on the need for frequency information, i.e., the activity level is more uncertain than the emission factor. However, even with a limited occurrence, the emission factor indicates that landfill fires have the potential to be a very large dioxin/furan source. In addition, information is needed on current regulations regarding landfills. At the time of this report preparation, landfill fires received no GLBTS priority designation in the U.S. or Canada due to a lack of information.

3.2.10 Other Smaller Sources

Forest Fires. A quantitative emissions estimate for dioxin/furan releases from forest, brush, and straw fires of 208 g I-TEQ_{DF} in 1995 was made in the 1998 Draft Inventory (USEPA, 1998) and in the updated draft Dioxin Reassessment (USEPA, 2000b). As this represented approximately 8% of the total quantified releases to air in the U.S. in 1995 in these versions of the inventory, this source was evaluated as part of the decision tree process by the workgroup. However, in revisions to the updated draft Dioxin Reassessment for SAB review (USEPA, 2000c), dioxin emissions from forest, brush and straw fires are expected to receive a lowered confidence rating of "D". As a result, they will be considered preliminary estimates and will not be included in the total quantifiable inventory.

Currently, other agencies, including the U.S. Forest Service and Department of Interior, have the primary lead on wildland fire management in the U.S., although EPA issued an Interim Air Quality Policy on Wildland and Prescribed Fires in 1996 in an effort to control particulate matter emissions from prescribed burning. Generally, other issues and concerns have a greater influence on fire management policy than dioxin/furan emissions. Therefore, in light of the current program structure, the workgroup concluded there are limited opportunities for dioxin/furan reductions from forest fires.

Acknowledging that the GLBTS decision tree ranking process is intended to identify the most obvious or important sources for workgroup focus, forest fires did not qualify, per the GLBTS workgroup's assessment, as a high GLBTS priority at this time. The rationale for this low GLBTS priority designation was based on the limited reduction opportunities for the workgroup. The workgroup designated forest fires as a low GLBTS priority with the condition that the open burning subgroup would look further into the significance of agricultural burning.

Diesel Fuel Combustion. Quantitative emissions estimates for dioxin/furan releases from diesel fuel combustion have been made in the U.S. and Canada. In the updated draft U.S. Dioxin Reassessment (USEPA, 2000b), diesel fuel combustion has been given a confidence rating of "C", which indicates that the characterization of diesel fuel combustion was judged to be adequate for quantitative estimation with low confidence in either the emission factor and/or the activity level. This source marginally meets the GLBTS criteria of a "significant" source category, comprising about 1.3% percent of the total quantified releases to air in the U.S. in 1995 (USEPA, 2000b), and 8.9% of the total 1999 Ontario Emissions Inventory.

Acknowledging that the GLBTS decision tree ranking process is intended to identify the most obvious/important sources for workgroup focus, diesel fuel combustion did not qualify, per the GLBTS workgroup s assessment, as a high GLBTS priority at this time. The rationale for this low GLBTS priority designation was based on limited reduction opportunities for the workgroup, and the fact that this sector represents a relatively minor source (i.e., it has relatively low emissions estimates compared to the other sectors that have been discussed). Estimated emissions from diesel fuel combustion in the U.S. were below the 2% cutoff point for prioritization consideration. In Canada, although dioxin/furan releases from diesel fuel combustion are a larger percent of the total Ontario inventory (~8.9%), diesel fuel is in the process of being addressed by EC under new authority granted in April, 2000. EC will now have authority to regulate both engine emissions and fuel content for vehicle engines, which used to be solely regulated by the Ministry of Transportation.

Utility Coal Combustion. Quantitative emissions estimates for dioxin/furan releases from utility coal combustion have been made in the U.S. and Canada. In the updated draft Dioxin Reassessment (USEPA, 2000b), utility coal combustion has been given a confidence rating of B , which indicates that characterization of this source was judged to be adequate for quantitative estimation with medium confidence in the emission factor and at least medium confidence in the activity level. Quantitative emissions estimates, based on stack testing of six of 29 Canadian facilities, have also been made in Ontario. This source marginally meets the GLBTS criteria of a significant source category, comprising about 2.4% of the total quantified releases to air in the U.S. in 1995 (USEPA, 2000b), and about 2% of the total 1999 Ontario Emissions Inventory.

There are currently no federal or state restrictions on dioxin emissions from coal-fired utilities, and EPA has been congressionally required to defer regulation until the findings of a National Academy of Science (NAS) Report is completed (July 2000). The Agency also announced on April 25, 2000 that national non-hazardous waste standards under RCRA Subtitle D are needed for coal combustion wastes disposed in surface impoundments and landfills and used as minefilling. Therefore, it was concluded that there are limited opportunities for further dioxins/furans reductions from the utility coal combustion sector at the time of this report preparation.

Utility coal combustion was designated as a low GLBTS priority at this time, based on limited reduction opportunities for the workgroup, and the fact that this sector represents a relatively minor source (i.e., it has relatively low emissions estimates compared to the other sectors that have been discussed). In addition, estimated emissions from utility coal combustion (at 2.6% of the U.S. inventory and 2% of the Ontario inventory) are very close to the 2% cutoff point below which this sector would not even enter the GLBTS prioritization consideration.

Wood Waste Combustion. In the U.S., wood combustion is regulated via New Source Performance Standards (NSPS) for particulates, fuel restrictions, and boiler specifications. It was determined in workgroup investigation that salt-laden wood (which can result in elevated dioxin emissions) was not included in the wood waste combustion category in the Ontario Inventory,

because this was associated only with the west coast of Canada. Alternatives for wood waste disposal were considered in workgroup analysis of this sector. Currently, the different types of facilities that may burn waste wood products include pulp and paper mills, sawmills, and general forestry product operations. The potential for land application as a means of disposal for wood waste was considered because, although this waste has value as fuel, it is not hazardous and in theory could be put back into areas where clear cuts had occurred. However, in the U.S., logistics and economics were identified as important limiting factors in implementing this alternative. For example, hauling costs may be elevated due to the different types of trucks that are required to haul wood waste. In addition, because the wood scrap material is light, the cost of transportation per ton greatly increases. Wood waste also has preferred value as a fuel source or as a mulch / landscaping product (wood material mixed with soil, etc. is often composted because it is unsuitable for burning in industrial boilers). Additionally, in the U.S., a large quantity of the harvested timber comes from private lands and these areas generally do not want the wood waste back. In Canada, on the other hand, private lands are not an issue because about 99% of the logged lands are government owned.

The wood waste combustion sector was designated as a low GLBTS priority at this time. The rationale for this low GLBTS priority designation was based on limited opportunities for the workgroup, and the fact that this sector represents a relatively minor source (i.e., it has relatively low emissions estimates compared to the other sectors that have been discussed). In addition, estimated emissions from wood waste combustion (at <2% of the U.S. inventory and 2% of the Ontario inventory) are very close to the 2% cutoff point below which this sector would not even enter the GLBTS prioritization consideration.

Hazardous Waste Incinerators. Quantitative emissions estimates for dioxin/furan releases from hazardous waste incinerators have been made in the U.S. and Canada. In the updated draft U.S. Dioxin Reassessment (USEPA, 2000b), hazardous waste incineration has been given a confidence rating of B , which indicates that characterization of hazardous waste incineration was judged to be adequate for quantitative estimation with medium confidence in the emission factor and at least medium confidence in the activity level. Quantitative emissions estimates, based on stack testing of both Canadian facilities, have also been made in Ontario. While this source does not meet the GLBTS criteria for a candidate significant source category based on U.S. emissions (at 0.2% of the total quantified releases to air in the U.S. in 1995), it marginally meets the GLBTS criteria at 2.1% of the total 1999 Ontario Emissions Inventory.

In the U.S., hazardous waste incinerators are subject to same regulatory controls (under CAA and RCRA) as hazardous waste burning cement kilns. In Canada, the CWS process to establish reduction targets is underway with draft standards currently proposed. CWS are predicted to result in reductions of as much as 97% nationally.

Hazardous waste incineration was designated as a low GLBTS priority at this time. The rationale for this low GLBTS priority designation was based primarily on the fact that this sector represents a relatively minor source (i.e., it has relatively low emissions estimates compared to the other sectors that have been discussed). In addition, estimated emissions from hazardous

waste incinerators are very close to the 2% cutoff point below which this sector would not even enter the GLBTS prioritization consideration.

4.0 PROPOSED OPTIONS FOR ACHIEVING FURTHER DIOXIN/FURAN EMISSIONS REDUCTIONS

4.1 STRATEGIC APPROACH

Based on the results of the decision tree analysis, the GLBTS dioxin/furan workgroup has designated four sectors for initial priority focus in pursuing the GLBTS goal of achieving additional reductions in anthropogenic sources of dioxin emissions in the Great Lakes basin. These sectors include medical waste incineration (in Canada only), backyard trash/open burning, residential wood combustion, and pentachlorophenol (PCP) treated wood (in the U.S. only). In addition, the workgroup has not assigned a priority level to steel manufacturing (EAF) in the U.S., secondary copper smelting in Canada, or landfill fires in either country due to insufficient data available to fully characterize the significance of these sources in the Great Lakes basin. Better information on ash management from municipal and medical waste incineration was also identified as a follow-up issue for the workgroup. Therefore, reduction options identified by the workgroup focus on these priority sectors and information needs. In looking across the proposed options discussed below, certain common elements can be identified which form the basis of a unifying strategic approach towards implementation of cost-effective reduction options. These strategic elements are to:

- Conduct coordinated outreach efforts
- Address key information gaps
- Periodically assess progress and success of programs in place and re-evaluate potential for further reductions, and
- Coordinate with the National Strategy and Dioxin Exposure Initiative

Conduct Coordinated Outreach Efforts

Outreach efforts will focus on increasing public awareness concerning sources of dioxins and the steps the public can take to help reduce dioxin and furan releases. These efforts will be coordinated as possible with other workgroup efforts and broader PBT outreach efforts. For example, outreach efforts to reduce open burning may provide an opportunity to coordinate with other GLBTS workgroups, as well as with an integrated GLBTS effort to build awareness of strategy goals and opportunities for public involvement.

Address Key Information Gaps

Additional information was identified as a need for several targeted sectors, including: waste incineration (ash disposal), backyard trash/open barrel burning (prevalence and factors), residential wood combustion (dioxin emissions from wood stoves), PCP treated wood (disposal fate of utility poles), steel EAF (emissions in the U.S.), secondary copper smelting (emissions in

Canada), and landfill fires (activity levels). In certain cases (i.e., steel manufacturing, secondary copper smelting, and landfill fires), these information gaps precluded the assignment of a GLBTS priority level to a given sector. Therefore, addressing these information needs will be a key focus area for the dioxin workgroup.

Periodically Assess Progress and Success of Programs in Place and Re-evaluate Potential for Further Reductions

Efforts directed towards dioxin/furan sources that were considered by the workgroup and designated as low GLBTS priority (on the basis of either low emissions or limited potential for further reductions beyond existing programs) will not be a key workgroup focus at this time. For these sectors, however, the workgroup recognizes the need for and commits to periodic workgroup review of progress and/or continued success of regulatory and non-regulatory mechanisms in place for these sectors. For example, the workgroup will periodically assess progress in compliance with dioxin air emission reduction programs for the incineration sectors, including MACT standard implementation in the U.S. and Canada Wide Standard development in Ontario. To conduct this review in the U.S., the workgroup will utilize the improved centralized database currently being developed by EPA to hold information being collected on control technology compliance, including emissions from MWCs, MWIs, hazardous waste incinerators, cement kilns, and the pulp and paper industry. This data is being collected as part of MACT and Best Available Technology (BAT) regulations and compliance testing reports.

The workgroup also recognized the need for periodic reassessment of new information that might indicate the need to reconsider a source s priority designation.

Coordinate with the National Strategy and Dioxin Exposure Initiative

Using the U.S. Dioxin Reassessment and emerging scientific understanding of dioxin sources, fate and transport, levels of human exposure, and toxic effects on humans and other animals, EPA is in the process of reviewing its national dioxin control efforts to determine if, collectively, they adequately address dioxin risks, and to determine if redirected or additional action is needed. The result of this multi-program dioxin review will be a draft EPA Cross-Media Dioxin Strategy that will be released concurrent with the final EPA Dioxin Reassessment scheduled for completion in early 2001. Although the Cross-Media Dioxin Strategy is broader in focus than the GLBTS (e.g., addressing exposure reduction), close coordination between the GLBTS to achieve further reductions in anthropogenic dioxin emissions and the Cross-Media Dioxin Strategy is essential to an effective national strategy.

4.2 KEY PROPOSED ACTIONS

4.2.1 Municipal Waste Combustion (MWC) and Medical Waste Incineration (MWI)

Gather Information on Ash Management. The primary GLBTS opportunity related to waste incineration at the current time is to further examine the issue of ash management. In the

assessment process, the GLBTS dioxin workgroup concluded that, although these sectors were deemed a low GLBTS priority in the U.S., a more systematic inventory was needed on the management and disposal fate of fly and bottom ash from waste incineration. In particular, an information gap was identified on the land disposal practices actually occurring within the Great Lakes watershed. The gathering of disposal information for MWCs is predicted to be relatively easy because there are a limited number of facilities in the basin. On the other hand, because there are many more MWI facilities in the basin, gathering information on medical ash disposal might be more challenging.

Proposed steps in the development of the ash disposal information include:

1. Assess available information and determine whether the information on ash disposal is already adequately available (e.g., state reports to federal government, state agencies/solid waste authorities, and industry experts), or if it requires new data collection. This investigation would include an assessment of data accessibility and the quality of reporting records.
2. If additional data are needed, design a plan for additional data collection (e.g., determine whether to conduct a full inventory or representative sampling).
3. Implement the data collection plan.

4.2.2 Open Burning

As a high GLBTS priority area, the dioxin/furan workgroup has already initiated an open burning subgroup to address key identified opportunities, discussed below, for this dioxin source. Although the subgroup is in the early stages of planning, an initial task the subgroup has considered is conducting a complete assessment of regulations related to open burning in the Great Lakes region, and considering options for outreach. The subgroup has also discussed the potential for conducting educational outreach on open burning, possibly as an extension of a Duluth, Minnesota, open burning outreach campaign that is already planned.

Overall, there are three main categories of opportunity that are being considered for achieving dioxin reductions from open burning. These are:

- Strengthening and/or enforcement of local regulatory mechanisms,
- Public education and outreach, and
- Development of the necessary infrastructures to allow practical alternatives to open burning.

In addition to these opportunities, further examination of reduction potential related to agricultural burning also represents a GLBTS workgroup opportunity. Recognizing data gaps related to the significance of agricultural burning in the Great Lakes basin, the workgroup has identified research on this issue as a primary initial goal.

Regulatory Mechanisms. Although federal regulation of open burning does not exist, open burning is often banned or limited by many local governments. However, enforcement of these local regulations has been identified as a key weakness in achieving reductions in open burning. For example, in Wisconsin, although open burning laws require permits for burns, there is no effective mechanism in place to penalize violators. Therefore, a major challenge regarding open burning is to encourage the strengthening of enforcement of local regulatory mechanisms. Specific opportunities for the dioxin workgroup in this area have not yet been identified.

Public Education and Outreach. Recognizing current limitations of regulatory mechanisms for controlling open burning, a major GLBTS opportunity for achieving dioxin reductions from open burning lies in public education and outreach to help change behavior. Proposed components of this effort include:

- Developing and distributing information on the general prevalence of open burning
- Understanding why people engage in backyard burning where alternatives do exist and other factors which affect the extent of open burning
- Defining cost-effective options for outreach
- Preparing informational pamphlets and other outreach material on open burning (public education materials with alternatives)
- Conducting a basinwide campaign, possibly in coordination with other GLBTS workgroups.

Potential methods discussed for future efforts that may be conducted by interested stakeholders to quantify the prevalence of backyard burning include surveys, or possible comparison of per-capita waste generation in rural areas to the quantity of waste that is disposed in landfill or other municipal collection. A survey similar to that conducted by the Western Lake Superior Sanitary District (WLSSD) (see discussion in section 3.2) to assess opinions and determine motives for open burning, but focused on those who are actively practicing open burning, was also identified by the workgroup as having potential use in this information gathering effort.

In addition, EPA and EC support sector-based approaches that address multiple GLBTS chemicals where applicable, and encourage the coordination of reduction activities, as possible, with other GLBTS workgroups. Outreach and education related to open burning may represent a potential opportunity for coordination with other GLBTS workgroups, particularly the GLBTS benzo(a)pyrene (B(a)P) workgroup.

Assessment and Support of Infrastructure Needs. Early indications from surveys such as the WLSSD survey suggest that infrastructure changes may be required to obtain significant reductions in open burning. The cost of local waste collection services, the proximity of recycling or drop-off centers to most residences, storage of waste at both the residential and community level, and health concerns associated with waste storage and management all represent community infrastructure realities that will influence the feasibility of achieving reductions in open burning. The first step is to understand the key infrastructure issues that affect

the practice of open burning. The next step is to explore feasible, cost-effective options for creating an infrastructure that will support reductions.

4.2.3 Residential Wood Combustion

Based on high emissions estimates and the presence of opportunities to promote reductions (i.e., due to the lack of regulatory control), the GLBTS dioxin/furan workgroup concluded that residential wood combustion should be designated as a high GLBTS priority for dioxin/furan workgroup actions. Pending additional information on the extent to which the newer EPA-certified wood stoves reduce dioxin emissions, the dioxin workgroup may consider future coordination with the GLBTS B(a)P workgroup on voluntary reduction initiatives such as wood stove changeovers. Efforts aimed at residential wood combustion have already been initiated by the B(a)P workgroup, and consist of pilot projects to gauge the regional response and potential impacts of wood stove changeover (i.e., to EPA-certified, etc.). These pilot projects consist of outreach to communities and coordination with industry sponsors.

Wood stove changeover programs promote the replacement of older wood stoves with newer, EPA-certified wood stoves with PM control technology, as well as natural gas stoves and log sets. The newer EPA-certified stoves are known to reduce particulate matter (PM) emissions and B(a)P, but the exact nature of the association between dioxins/furans and PM is currently unclear. Changeovers to gas and liquid propane heating units, however, are known to be effective in reducing dioxin/furan emissions. Additional research on the nature of dioxin/furan releases from wood stoves is currently being finalized in the Canadian wood stove testing program, with the goal of assessing the dioxin reduction potential of EPA-certified stoves. The study will compare emissions from conventional and new certified wood stoves and will help to determine effectiveness of particulate matter (PM) controls on dioxin/furan emissions from wood stoves. Following assessment of this forthcoming research on dioxin emissions from wood stoves, the workgroup can more accurately assess the extent to which they should coordinate on wood stove changeovers with the B(a)P workgroup, and if necessary, develop additional proposed actions that will result in emission reductions from RWC.

4.2.4 Pentachlorophenol Treated Wood

Based on the large amount of dioxin contained in PCP-treated wood and the lack of information on the ultimate disposal fate of PCP-treated utility poles, the GLBTS dioxin/furan workgroup concluded that PCP treated poles in the U.S. would be designated as a medium GLBTS priority. This priority designation will be revisited by the workgroup, dependent on more information becoming available regarding de facto disposal. Although the data identified on PCP pole disposal (i.e., information presented at the February 1999 utility pole conference in Florida which showed that about 50% of poles taken out of service did not have controlled disposal) are not definitive, it is the best information currently available for use by the workgroup for default assumptions until new information surfaces. Due to the large mass of PCP involved, the workgroup concluded that a burden of proof is required to confirm the degree to which used poles are disposed of properly. The key opportunity for immediate workgroup focus is to verify

that all PCP treated utility poles (recycled poles included) are being properly managed to the end of their useful life. In contrast to some of the other dioxin sources, which are being primarily addressed with emissions reductions efforts, efforts directed towards PCP-treated poles will focus on preventing potential releases of dioxins from a large reservoir source existing as man-made products.

As a first step in the information gathering process, the Utilities Solid Waste Activities Group (USWAG) is currently planning an information gathering effort on the disposal and fate of utility poles in the Great Lakes basin. When finalized, the results of the USWAG information gathering survey will be assessed by the workgroup and used to focus future priority actions and identify any other information needs. For example, because the USWAG survey will focus only on utilities, the secondary reuse market fate may still remain an unknown and require additional research. Once information from the survey is available, a re-assessment of the importance of this source will be considered.

Additional information needs pertaining to PCP-treated poles have also been identified by the dioxin workgroup, including: details on the regulatory drivers that may affect pole disposal in the U.S., and information on whether there is an infrastructure in place to trace these recycled/reused poles.

Although PCP treated wood was designated as a low GLBTS priority in Canada due to significant controls and a life-cycle analysis study of PCP treated wood that is underway through the Canadian Wood Preservers SOP, progress under the SOP will be assessed by the workgroup as it develops, including results of the life-cycle analysis study for utility poles/railroad ties and the development of best management options.

4.2.5 Steel Manufacturing (EAF)

Because the dioxin workgroup was unable to determine a priority designation for steel manufacturing EAF due to a lack of testing data, the key proposed opportunity for future workgroup focus is to determine whether dioxin/furan testing is feasible at U.S. steel EAF facilities, and if so, to explore how to conduct this testing. Proposed steps and support efforts for dioxin/furan testing at U.S. steel EAF facilities include:

- Determine whether there are any U.S. steel EAF facilities interested in conducting voluntary testing
- Identify incentives to help encourage voluntary testing by the steel industry
- Determine any opportunities for financial support for testing
- Coordinate with steel industry trade associations on voluntary testing
- Develop EPA guidance for testing (e.g., hand-in-hand testing), or provide EPA peer review of industry-conducted testing.

Alternatively, forthcoming Canadian data may be evaluated relative to its potential use for developing U.S. estimates, if stack emissions testing of U.S. steel facilities is not feasible.

In addition, the steel EAF industry represents a likely candidate for coordination of multiple monitoring activities (i.e., multiple GLBTS chemicals). For example, with the increased interest in mercury emissions (e.g., from auto scrap use at EAF), opportunities to combine mercury and dioxin/furan monitoring may exist. As a first step, the key workgroup opportunity regarding coordination is to discuss the issue with other GLBTS workgroup co-leads, and to follow up on the issue with the GLBTS Integration Group.

4.2.6 Landfill Fires

Landfill fires received no GLBTS priority designation in the U.S. or Canada due to a lack of information. Reduction opportunities depend on information regarding the frequency and nature of landfill fires. Primary focus areas for information gathering efforts that were identified by the dioxin workgroup include:

- Frequency of landfill fires in both the U.S. and Canada (i.e., activity level estimates are needed)
- Current regulations regarding landfills
- Factors associated with the outbreak of landfill fires
- Emission factors for landfills.

Potential information sources on the frequency of landfill fires identified by the workgroup include:

- Operating permits (all landfill fires must be reported under the conditions of a facility s operating permit)
- States and/or solid waste authorities who issue landfill permits
- The possibility of a central repository (e.g., of state reports) within the federal governments.

4.3 NEXT STEPS

Next steps for the dioxin workgroup will be to develop detailed plans for implementing reduction and/or information gathering projects for the sectors designated high or medium priority or identified as needing additional data in this GLBTS Step 3 analysis. The plans will be implemented as Step 4 of the GLBTS four-step process: Implementing actions to work toward the goal of virtual elimination.

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